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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/846,536	05/02/2001	Wen-Ting Chu	TS1999-646B	4121

7590 04/26/2002
George O. Saile
20 McIntosh Drive
Poughkeepsie, NY 12603

EXAMINER

NADAV, ORI

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 04/26/2002

6

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/846,536

Applicant(s)

CHU ET AL.

Examiner

ori nadav

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 March 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 20-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 20-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

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DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 20-24 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. There is no support for a continuous upper level metal interconnect structure, comprised of a single metal element, comprising a lower level metal interconnect structure, a metal plug structure; and an upper level metal interconnect structure, as recited in claim 20.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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4. Claims 20 and 24, insofar as in compliance with 35 U.S.C. 112, is rejected under 35 U.S.C. 102(b) as being anticipated by Harada et al. (5,341,026).

Harada et al. teach in figure 1 a continuous upper level, metal interconnect structure, comprised of a single metal element on a semiconductor substrate 1, comprising a lower level, metal aluminum interconnect structure 4, an insulator layer 5 on the lower level, metal interconnect structure; a via hole in the insulator layer exposing a portion of a top surface of the lower level, metal interconnect structure, a recessed tungsten metal plug structure 206, located in a bottom portion of the via hole, with the recessed metal plug structure overlying and contacting the portion of the lower level, metal interconnect structure 4, exposed in the via hole; and the upper level, metal aluminum interconnect structure, comprised of a metal structure component, and of an aluminum metal ring component, with the metal structure component 103 only on one side of via hole metal structure 103 is located only on the right side of via hole, and is not located on the left side of via hole wherein the depression in insulating layer 8 is noted), located on a portion of a top surface of the insulator layer, and also located on an edge of underlying, the recessed metal plug structure, and with the metal ring component attached to the metal structure component, and located overlying, and contacting portions of a top surface of the recessed metal plug structure, with the metal ring component comprised of metal spacers on the sides of atop portion of the via hole.

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Although Harada et al. do not explicitly state that layer 206 is a recessed plug, layer 206 can very well be characterized as a recessed plug, because layer 206 is formed in a bottom portion of the via hole, overlying, contacting and connecting the lower interconnect level 4 to the upper interconnect level. Therefore, Harada et al. teach a recessed plug, as claimed.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 21-23, insofar as in compliance with 35 U.S.C. 112, are rejected under 35 U.S.C. 103(a) as being unpatentable over Harada et al. (5,341,026).

Regarding claim 21, Harada et al. do not teach a lower level metal interconnect structure with an underlying and overlying titanium nitride layer. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a lower level metal interconnect structure with an underlying and overlying titanium nitride layer in Harada et al.'s device in order to provide conventional barrier around the lower level metal aluminum interconnect structure, of which official notice is taken.

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Regarding claims 21-23, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a lower level metal aluminum interconnect structure at a thickness between about 2000 to 20000 Angstroms, with an underlying titanium nitride layer, at a thickness between about 100 to 1500 Angstroms, and an overlying titanium nitride layer, at a thickness between about 100 to 1500 Angstroms, wherein the via hole is comprised with a diameter between about 0.10 to 1.0 microns, and wherein the recessed metal plug structure, is comprised of tungsten, with the height of between about 3000 to 20000 Angstroms, and metal aluminum ring structure in Harada et al.'s device, since it is a matter of design choice within the skills of an artisan, subject to routine experimentation and optimization.

Response to Arguments

7. Applicant's arguments with respect to claims 20-24 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 and 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

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Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to *Examiner Nadav* whose telephone number is **(703) 308-8138**. The Examiner is in the Office generally between the hours of 7 AM to 3 PM (Eastern Standard Time) Monday through Friday. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas, can be reached at **(703) 308-2772**.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is **308-0956**

Ori Nadav

April 25, 2002

Steven Loke
Primary Examiner

